Wilson, E.O. 1964.

BREVIORA

Museum of Comparative Zoology

CAMBRIDGE, MASS. NOVEMBER 12, 1964 NUMBER 210

THE ANTS OF THE FLORIDA KEYS

BY EDWARD O. WILSON

Biological Laboratories, Harvard University

The Florida keys should be of more than usual interest to zoogeographers on several grounds. They are an extensive subtropical archipelago adjacent to the United States mainland, easily reached by a main highway that runs for almost their entire length. They are in the hurricane belt, providing an opportunity to study the effects of severe periodic storms on population dynamics and dispersal. Finally, they are separated by the Florida current of the Gulf Stream — a narrow but formidable faunistic barrier — from the topographically similar Bimini Islands, with which they can profitably be compared.

These advantages induced me to make a special collecting trip in June, 1958, to conduct an initial faunal survey. Time permitted only several islands to be investigated thoroughly. I selected Key Largo, Plantation Key, Big Pine Key, and Key West in order to insure the maximum geographic spread and diversity of habitats (see Davis, 1943, and Duellman and Schwarz, 1958). The ant fauna of the Bimini Islands had already been surveyed by M. R. Smith (1954), while other studies of Floridian ants were available in the publications of Wheeler (1932) and Van Pelt (1956, 1958).

The project was supported in part by a grant from the National Science Foundation. I am grateful to my wife Irene for her assistance in the collection of specimens and recording of ecological information.

ZOOGEOGRAPHIC ANALYSIS

In Table 1 the Keys fauna is classified according to nest site and probable origin. From a consideration of this partition plus

other data given in the Systematic List later, the following generalizations are permissible.

1. Elements introduced by human commerce are numerically more prominent in both species and individuals than on the Florida mainland. Eight of the 30 species recorded, or 26.7 per cent, are in this category. In the Welaka Reserve in central Florida, according to published data by Van Pelt (1958), 8 of 75 species, or only 10.7 per cent are in this category. The prevalence of introduced "tramp" species is shared with most other small islands in the tropics, including Bimini, hence is a distinctly "insular" trait. (Of 12 introduced species occurring jointly in the Keys and Welaka Reserve, only four are held in common: *Cardiocondyla emeryi, Tetramorium guineense, Monomorium floricola,* and *Paratrechina longicornis.*)

2. The Antillean elements are mostly arboricolous, whereas the Floridian elements are mostly terricolous.

3. Most of the arboricolous (hence Antillean) elements are very well adapted to life in the mangrove swamps, maintaining unusually dense populations there. The same species also occur, for the most part, in other habitats in the interiors of the Keys.

4. The arboricolous elements make up a disproportionate part of the Keys fauna. Twelve of the 30 species, or 40 per cent, are in this ecological category; on the other hand, only 12 of 75, or 16 per cent, are arboricolous in the Welaka Reserve of Central Florida. Judging from data by Smith (1954), the Bimini fauna resembles that of the Florida Keys in this respect; of 23 species for which there is ecological information, 8 or 34.8 per cent are arboricolous.

Generalizations (2), (3), and (4) are probably interrelated. The mangrove swamps provide an excellent portal into such small islands as the Florida Keys. They form an extensive, persistent habitat around most of the margins of the islands. During severe storms, such as the famous hurricanes of 1935 and 1960 (Craighead and Gilbert, 1962), the mangroves were badly damaged but not exterminated. In 1960 many tree branches were torn loose and undoubtedly transported long distances by sustained winds of 140 mph over a period of nearly 36 hours. Such debris, unless submerged in water or literally torn to shreds, should provide vehicles of transport for intact colonies

of the arboricolous ant species found in the Keys, although the point has not been confirmed. The rapid regrowth of the mangrove swamps would provide the means for the reproduction of these propagules.

The terricolous ant species, on the other hand, are not so well favored. Subterranean and log-dwelling colonies are not likely to be transported intact by the high winds. At the same time they are much more susceptible to mortality by drowning. In the hurricanes of 1935 and 1960, tides of 11 to 18 feet were reported. The effects on the ground ant fauna were not studied but must have been extensive.

In sum, it is reasonable to postulate a higher immigration rate and lower extinction rate for arboricolous species in comparison with terricolous species in the Florida Keys. Whether or not the fauna is in equilibrium (see MacArthur and Wilson, 1963), it follows that it should consist disproportionately of arboricolous species. Hence generalization (4) of the present study seems to have a reasonable explanation in one aspect of the physical environment. But further field studies before and after tropical storms are clearly needed to illuminate this interesting situation.

The faunas of the Florida Keys and Bimini Islands show some striking differences. There are, to begin with, the set of inferred ecological vicars listed in Table 2. In at least one case, *Solenopsis geminata* versus *Pheidole megacephala,* the two species are known to compete directly and replace each other on very small islands in the West Indies and Pacific. Whether this is also the case for the other pairs might be determined by experimental introductions. According to the hypothesis, such introductions of one vicar into the territory of the other should result in few successful colonizations.

Certain species appear to have no ecological equivalents. For the Bimini group this is true of the Antillean and endemic elements *Macromischa pastinifera, Smithistruma nigrescens,* and *Brachymyrmex obscurior.* For the Florida Keys it is evidently true of the species *Aphaenogaster miamiana* and *Xenomyrmex floridanus.* Again, experimental introductions, conducted for comparative purposes with exchanges of the hypothesized ecological equivalents listed above, might prove instructive. According to the hypothesis, this second class of introductions should prove relatively successful.

SYSTEMATIC LIST

PLATYTHYREA PUNCTATA (Fr. Smith)

Center of Key Largo, winged queen at light, June 14. Ranges from northern South America to southern Texas, also throughout the West Indies to the Bahamas and southern Florida.

ODONTOMACHUS RUGINODIS Wheeler

Key Largo, Big Pine Key.

According to W. L. Brown (*in litt.*) *ruginodis* is the correct name for the Floridian species, whereas *insularis* is correctly applied to the species referred to by Smith (1945) as *insularis* var. *pallens* Wheeler. *O. ruginodis* ranges from the United States through the West Indies to South America as far south as Paraguay. Within the United States it is found throughout Florida and reaches extreme southern Georgia and southeastern Alabama. An isolated population, probably introduced, occurs within the city limits of Mobile, Alabama.

This large ponerine, distinguished by its trap-like mandibles, was very abundant in undisturbed tropical hammocks in the center of Key Largo. Colonies were found nesting in cavities in the rather thick leaf litter. On Big Pine Key two colonies were found nesting beneath logs in open pine-palmetto woods.

PSEUDOMYRMEX ELONGATUS Mayr

Key Largo, Plantation Key, Big Pine Key, Key West (winged males in nest June 21).

Ranges from Brazil north through the West Indies to the Bahamas and southern Florida.

This typically tropical species was abundant on trees in open habitats, including mangrove swamps, lawns, and disturbed hammocks on Plantation Key. On Key Largo it did not penetrate the denser hammocks in the center of the island. Colonies were found nesting in hard dead twigs attached to living trees.

PSEUDOMYRMEX PALLIDUS Fr. Smith

Big Pine Key.

A species adapted primarily to savannas, *P. pallidus* ranges around the Caribbean from the West Indies through the coastal plain of the Gulf States into Mexico.

On Big Pine Key, *P. pallidus* occurred in both the mangrove swamps and on grass in the open pine-palmetto woods of the interior. Colonies were found nesting in dead hollow twigs attached to live mangrove trees.

Cardiocondyla emeryi Forel

Plantation Key, Key West.

A pantropical "tramp" species that originated in Africa and has been introduced in the New World, including the warmest parts of the Gulf States, by human commerce.

Workers were found foraging on hot, bare ground in open habitats during the day. The species is generally limited to the most disturbed habitats.

Crematogaster ashmeadi Mayr

Key Largo (a series in Museum of Comparative Zoology collected in 1904), Plantation Key, Big Pine Key, Key West.

Limited to the United States, from the Florida Keys north to North Carolina and southern Tennessee and west to Texas.

The workers occur in trees in mangrove swamps, lawns, and disturbed hardwood forest. None could be found in the deep hammocks of Key Largo. Nests were found in dead, dry branches of living trees and (in one instance) under loose bark on the trunk of a small tree.

Pheidole floridana Emery

Big Pine Key (males in nest June 19-20).

The above specimens compare well with *floridana* syntypes and are closer to other Florida material placed with this species than to the closely related (and possibly conspecific) *flavens* Roger of Cuba and the Bahamas. Both *floridana* and *flavens* are highly variable but can be distinguished by apparently consistent sculptural characters in the soldier. *Floridana* is known only from Florida, and the Florida mainland is therefore the inferred source of the Keys population.

This small yellow species was abundant in open pine-palmetto woods, nesting in the soil beneath coral rock and rotting logs. Each colony appeared to contain between 100 and 200 workers.

APHAENOGASTER MIAMIANA Wheeler

Key Largo (North).

This native species, a typically Nearctic element, ranges over all or most of Florida, just reaching extreme southeastern Alabama.

A single colony, containing between 30 and 50 workers, was found nesting in a rotting log at the edge of a clearing in a dense tropical hammock.

TETRAMORIUM GUINEENSE (Fabricius)

Key Largo (Center).

This species originated in Africa and has been spread by human commerce throughout the tropics of both hemispheres. It is a characteristic element of disturbed habitats everywhere, even in the smallest, most remote oceanic islands.

Workers were found foraging at sunset on the trunk of a guava tree and fronds of a small royal palm in a lawn in the center of Key Largo.

TETRAMORIUM SIMILLIMUM (Fr. Smith)

Key West.

Like *T. guineense,* this little species evidently originated in Africa and has been spread by commerce throughout the tropics. Whereas *guineense* is predominantly arboreal, *simillimum* is mostly or entirely terrestrial.

PARACRYPTOCERUS (CYATHOMYRMEX) VARIANS (Fr. Smith)

Key Largo (North), Plantation Key (winged queens June 14), Big Pine Key, Key West.

According to W. W. Kempf (1958), *varians* occurs in southern Florida, south of Miami, in the Bahamas (Andros, New Providence, Bimini), and in Cuba and Jamaica. Previously published records of the species from Honduras, Trinidad, and northern South America were based on misdetermined specimens of *P. pallens* (Klug).

The species is abundant in the Florida Keys in a variety of major habitats. The workers are exclusively arboreal and nocturnal. Colonies were found nesting in hard, dead branches, one to two inches in diameter, attached to living trees of several species, including gumbo limbo, cocoplum, and mangrove. A

dealate queen, evidently in the act of nest-founding, was found in a dead branch on Plantation Key June 15. She was blocking the opening of a small cavity with her saucer-shaped head.

Strumigenys gundlachi (Roger)

Key Largo.

This characteristic Neotropical species also occurs in tropical Mexico, Central America, Trinidad, and the Greater Antilles. Brown (1959) records it from the Everglades National Park in Florida.

Two specimens, a worker and a dealate queen, were collected in leaf litter in a dense, relatively undisturbed hammock in northern Key Largo.

Xenomyrmex floridanus Wheeler

Key Largo (North), Plantation Key (winged males June 14, winged males and queens June 16), Key West (males June 21).

According to the recent revision of the genus by Creighton (1957), *X. floridanus* occurs in southern and central Florida, the Bahamas, Cuba, and Mexico.

Colonies were found in abundance along the edge of forest and in mangrove swamps everywhere I collected. They nested exclusively in dead branches of trees. Workers were found foraging singly and in files during the day. They are apparently exclusively arboreal.

Monomorium destructor (Jerdon)

Key Largo, Plantation Key.

This aggressive little species originated in the Old World tropics, possibly Asia, and has been spread by human commerce throughout the tropics.

Workers were abundant in lawns; a single colony was found nesting in the soil of a grassy roadstrip in North Key Largo.

Monomorium floricola (Jerdon)

Key Largo (North), Plantation Key, Key West.

M. floricola is a pantropical tramp species that originated somewhere in the Old World tropics.

Several colonies were located in dead branches of standing trees at the edge of hammocks.

MONOMORIUM PHARAONIS (Linné)

Plantation Key.

This remarkable species is perhaps the ant most intimately associated with man. Originating in Africa, it has been spread by commerce throughout the world. In the tropics it nests out-of-doors in disturbed habitats, while in temperate zones it is abundant in greenhouses and dwellings. On Plantation Key it was discovered in both situations. Colonies were abundant in dead tree branches in disturbed native woods, and workers were foraging in the walls of a restaurant far from any native woods.

SOLENOPSIS (S.) GEMINATA (Fabricius)

Big Pine Key.

This species, commonly referred to as the native fire ant, is found throughout the New World tropics, ranging northward well into the Gulf States. A reddish color phase, to which the Big Pine Key series belongs, occurs through much of this range and in addition has been carried by human commerce to many parts of the Old World tropics. It is especially successful in open habitats.

On Big Pine Key workers were found foraging over the crushed coral surface of a parking lot.

SOLENOPSIS (EUOPHTHALMA) GLOBULARIA (Fr. Smith)

Plantation Key, Big Pine Key (winged queens in nest June 19-20).

S. globularia ranges from the extreme south of Alabama and Mississippi through Florida and the West Indies to Mexico, Central America, Brazil, and the Galapagoes (Creighton, 1930). Through much of this range it is limited to the coast. In coloration and propodeal sculpturing the Keys samples are closer to series from Florida (subsp. *littoralis* Creighton) than to series from Cuba, Haiti, and Puerto Rico. Hence the Keys population can be inferred to have originated from Florida.

Near the center of Big Pine Key a single colony was found nesting in soil under a piece of coralline rock in pine-palmetto woods.

SOLENOPSIS (DIPLORHOPTRUM) LONGICEPS M. R. Smith

Key Largo (North).

Workers collected at the above locality correspond well with

longiceps paratypes in body proportions, pilosity, and color but are somewhat smaller in size. *Longiceps* ranges from Florida to Texas north to Tennessee (Creighton, 1950).

A single colony was discovered nesting in a small cavity in firm leaf litter on the floor of an undisturbed tropical hammock.

Solenopsis (Diplorhoptrum) picta Emery

Plantation Key (winged queens and males in nest June 15, 1958); Lower Matecumbe Key (collection by W. M. Wheeler, 1930).

The species is known from extreme southern Alabama through Florida to the West Indies and Central America.

The Plantation Key colony was found nesting in a dead stem in disturbed native woods. *S. picta* is characteristically an arboreal species.

Cyphomyrmex minutus Mayr

Key Largo (North) (winged queens and males in nest June 16); Plantation Key.

This common, primitive little fungus-grower ranges from extreme southern Alabama through Florida to the Bahamas, Greater Antilles, tropical Mexico, Trinidad, and South America as far south as Manaos.

On Key Largo a colony was discovered in a small, crumbling log in a relatively undisturbed tropical hammock. On Plantation Key one colony was nesting in the soil beneath a piece of coralline rock. Another was in rotting wood in a tree hole about three feet from the ground. Both were in disturbed, open native woods.

Tapinoma littorale Wheeler

Key Largo (North), Plantation Key (males in nest June 15), Big Pine Key (males June 19-20), Windley Key (queens and males at light June 17).

The species is distributed from extreme southern Florida to the Bahamas, Cuba, and Puerto Rico.

This was one of the most abundant ant species in leaf litter on the floor of undisturbed tropical hammocks on Key Largo. Colonies were found nesting in small pieces of rotting wood buried in the litter. Colonies were also abundant in dead stems attached to living bushes and trees, especially in disturbed forest

on Plantation Key and the mangrove swamp around Big Pine Key. Each colony appeared to consist of 100 to 300 workers and, in at least one case, up to several nest queens.

CONOMYRMA PYRAMICA (Roger)

Big Pine Key, Key West.

This distinctive, terrestrial dolichoderine ranges from New Jersey to Florida west to Arizona and southward through the West Indies to Mexico, Central America, western South America and the Galapagoes.

Colonies were found in open soil in elevated spots in the mangrove swamps.

PARATRECHINA (P.) LONGICORNIS (Latreille)

Key Largo, Plantation Key.

This species ranks with *Tetramorium guineense* as one of the most abundant and ubiquitous of all the pantropical "tramp" species of ants. It is characteristic of open, dry, highly disturbed habitats, from farmland to the centers of the largest cities. It originated somewhere in the Old World tropics.

On the Keys listed above, *P. longicornis* was common in completely open situations, especially around human dwellings. It was not found in the native woods. During a field trip to eastern Cuba in 1953, I noticed a similar distribution. *P. longicornis* workers abounded through sugar cane fields and along roads up to the very edge of the native forests that clung to limestone outcroppings; inside the forests, over a distance of only a few feet, they were replaced by native Cuban ant species.

PARATRECHINA (NYLANDERIA) BOURBONICA Forel

Key West.

This is another prominent pantropical "tramp" species of Old World origin. The Keys specimens have been compared with a syntype worker in the collection of the Museum of Comparative Zoology.

Workers were commonly seen foraging during the day at several locations on the streets of residential sections of Key West.

PARATRECHINA (NYLANDERIA) PARVULA (Mayr)

Key Largo (North).

The workers of species in the *parvula* complex are too similar

to make the present identification more than tentative. *P. parvula,* according to Creighton (1950), ranges from southern New York west to Iowa and Texas and south to Florida.

A single colony was found nesting in a small piece of rotting wood buried in leaf litter on the floor of a relatively undisturbed tropical hammock.

Camponotus abdominalis floridanus (Buckley)

Key Largo, Plantation Key, Big Pine Key.

C. floridanus is such a well-defined form with reference to the remainder of the *abdominalis* complex that it may well be a distinct biological species. I have used the trinomen in this case as an indication of the uncertainty of its biological status. *Floridanus* ranges from the east shore of Mobile Bay, Alabama, west through southern Georgia and south to the Florida Keys. The remainder of the *abdominalis* forms, which may or may not constitute a single species, range from southern Texas to Ecuador, the Amazon basin, and thence north again to the Lesser Antilles. The species is evidently absent from the Greater Antilles.

Floridanus is one of the most abundant and adaptable ant species in the Keys. It occurs in undisturbed and disturbed native hammocks and on the lawns around human dwellings but is evidently absent from mangrove swamps. Nests are formed in leaf litter, under rotting logs, and in dead branches of living trees. Workers forage during the day, mostly on vegetation.

Camponotus planatus Roger

Plantation Key (winged queens and males in nest June 14-18), Key West.

The species is found in extreme southern Florida and Texas, Cuba, Mexico, and Central America.

C. planatus is a very abundant species in tropical hammocks but rare or absent elsewhere. On Big Pine Key one colony was found in a small, isolated hammock, but not a single specimen was collected in the extensive pine-palmetto woods that dominate the unsettled part of the island. Unlike *floridanus, planatus* is absent from the vicinity of human dwellings. Colonies were found nesting in dead tree branches, both attached to living trees and lying loose on the ground. The alert, swift-running workers forage during the day.

Camponotus tortuganus Emery

Plantation Key (winged queen June 14), Big Pine Key.

As Creighton (1950) points out, the status of this form, originally described as a subspecies of the widespread tropical species *C. maculatus*, will remain unsettled until a careful revision can be made of the difficult species group to which it belongs. *Tortuganus* was originally described from the Dry Tortugas. As currently delimited it occurs on the Keys and in the Florida mainland as far north as Lake Worth.

A single colony was found beneath a rotting log in pine-palmetto woods on Big Pine Key.

Camponotus (Colobopsis) sp.

Big Pine Key.

A single colony belonging to the subgenus *Colobopsis* was found nesting in a dead stem in a mangrove swamp on the south shore of Big Pine Key. It is similar to *C. impressus* (Roger) but differs sufficiently in the shape of the propodeum of the minor worker to warrant distinguishing it as a different, and possibly undescribed species. Additional materials considered in the context of a generic revision are needed to clarify the matter.

SUMMARY

Thirty ant species are listed from the Florida Keys. The disproportionate fraction of introduced species is cited as a typically insular feature of the fauna. Also, an exceptional prevalence of arboricolous (and Antillean) species is noted and is hypothesized to be the outcome of the periodic severe tropical storms that alter the Keys environment. Finally, comparisons are made with the nearby Bimini Islands fauna.

Table I

Ecology and Zoogeographic Origin of the Keys Species

Terricolous

FLORIDIAN: *Aphaenogaster miamiana, Pheidole floridana, Solenopsis globularia, S. longiceps, Paratrechina parvula.*

ANTILLEAN: *Odontomachus ruginodis, Strumigenys gundlachi, Cyphomyrmex minutus.*

NATIVES OF UNCERTAIN ORIGIN: *Solenopsis geminata, Conomyrma pyramica, Camponotus tortuganus.*

INTRODUCED BY MAN: *Cardiocondyla emeryi, Tetramorium simillimum, Paratrechina longicornis, P. bourbonica.*

Arboricolous

FLORIDIAN: *Crematogaster ashmeadi.*

ANTILLEAN: *Platythyrea punctata, Pseudomyrmex elongatus, Xenomyrmex floridanus, Solenopsis picta, Paracryptocerus varians, Tapinoma littorale.*

NATIVES OF UNCERTAIN ORIGIN: *Pseudomyrmex pallidus, Camponotus (Colobopsis)* sp.

INTRODUCED BY MAN: *Tetramorium guineense, Monomorium floricola, M. pharaonis.*

Both Terricolous and Arboricolous

FLORIDIAN: *Camponotus abdominalis floridanus.*

ANTILLEAN: *Camponotus planatus.*

INTRODUCED BY MAN: *Monomorium destructor.*

Table II

Ecological Equivalents (with Zoogeographic Origins)

Florida Keys	Bimini Islands
Odontomachus ruginodis	*Odontomachus insularis*
Pheidole floridana (Floridian)	*Pheidole flavens* (Antillean)
Solenopsis geminata (Neotropical)	*Pheidole megacephala* (introduced)
Crematogaster ashmeadi (Floridian)	*Crematogaster steinheili* (Antillean)
Cyphomyrmex minutus (Antillean)	*Trachymyrmex jamaicensis* (Antillean)
Camponotus bermudezi (Antillean)	*Camponotus floridanus* (Antillean)
C. lucayanus (endemic)	*C. tortuganus* (Antillean?)
C. ramulorum (Antillean)	*C. planatus* (Antillean)
C. (Colobopsis) culmicola (endemic?)	*C. (Colobopsis)* sp. (endemic?)

REFERENCES

BROWN, W. L.

1959. The Neotropical species of the ant genus *Strumigenys* Fr. Smith: group of *gundlachi* (Roger). Psyche, **66**: 37-52.

CRAIGHEAD, F. C. and V. C. GILBERT

1962. The effects of hurricane Donna on the vegetation of southern Florida. Quart. J. Florida Acad. Sci., **25**: 1-28.

CREIGHTON, W. S.

1930. The New World species of the genus *Solenopsis* (Hymenop. Formicidae). Proc. Amer. Acad. Arts Sci., **66**: 39-151.

1950. The ants of North America. Bull. Mus. Comp. Zool., **104**: 1-585.

1957. A study of the genus *Xenomyrmex* (Hymenoptera, Formicidae). Amer. Mus. Novit., no. 1843, 14 pp.

DAVIS, J. H.

1943. The natural features of southern Florida, especially the vegetation, and the Everglades. Bull. Florida Geol. Sur., (Dept. Conservation), **25**: 1-311.

DUELLMAN, W. E. and A. SCHWARTZ

1958. Amphibians and reptiles of southern Florida. Bull. Florida State Mus., Biol. Sci., **3**: 181-324.

KEMPF, W. W.

1958. New studies on the ant tribe Cephalotini (Hym. Formicidae). Studia Ent., **1**: 1-68.

MACARTHUR, R. H. and E. O. WILSON

1963. An equilibrium theory of insular zoogeography. Evolution, **17**: 373-387.

SMITH, M. R.

1954. Ants of the Bimini Island Group, Bahamas, British West Indies (Hymenoptera, Formicidae). Amer. Mus. Novit., no. 1671, 16 pp.

VAN PELT, A. F.

1956. The ecology of the ants of the Welaka Reserve, Florida (Hymenoptera: Formicidae). Amer. Midl. Nat., **56**: 358-387.

1958. The ecology of the ants of the Welaka Reserve, Florida (Hymenoptera: Formicidae). Part II. Annotated list. Amer. Midl. Nat.,**59**: 1-57.

WHEELER, W. M.

1932. A list of the ants of Florida with descriptions of new forms. J. New York Ent. Soc., **40**: 1-17.